

**The Wild Cat (*Felis silvestris* Schr.)
and the Feral Domestic Cat:
Problems of the Morphology, Taxonomy,
identification of the hybrids
and purity of the wild population**

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Introduction

A number of publications consider the issues of the morphology of the European wild cat and that of the domestic cat, and many of them discuss the systematics of the wild cat (*Felis silvestris* Schr.). In spite of this fact these problems still remain arguable or unclear (POCOCK, 1951; HALTENORTH, 1957; WIEGEL, 1961; SCHAUENBERG, 1977; HEPTNER and SLUDSKY, 1972; CROVELLA et al., 1992; PUZACHENKO, 1992; HEMMER, 1993). (For the bibliography and the main concepts see: STAHL and LEGER, 1992; STAHL and ARTOIS, 1994). The question of the variability of the coloration patterns of the wild cat and the domestic cat with „wild“ (tabby = tiger) type of coloration is also not clarified (RAGNI, 1992). The characteristics of the coloration patterns of the wild cat are usually mixed up with those of the domestic cats even in the best faunistic publications and drawings. The reason for this is the fact that hybrid or sub-adult specimens with coloration patterns resembling that of the domestic cats were used. The issue of the coloration patterns is also important for the solution of another arguable conservation problem - whether the cross-breeding between the wild population and the feral European domestic cat exists, and what is the ratio of the cross-breeding (SUMINSKY, 1962; KRATOCHVIL et KRATOCHVIL, 1970; HEPTNER and SLUDSKY, 1972; RANDI et RAGNI 1991; CROVELLA et al., 1992; STAHL et ARTOIS, 1994).

The present paper is a synthesis of the results of a long term survey on the skull morphology and the systematics of *F. silvestris*. It also represents a summary of the results of a study on the coloration patterns of the wild European cat and the tabby (the tiger) type domestic cat, as well as of the study of the problem of the cross-breeding of the wild and the feral domestic cats in nature.

Materials and Methods

The qualitative features of more than 130 skulls of wild and domestic cats from Europe, Asia Minor and Northern Africa were examined parallel to the examination of some 500 furs of wild cats from Bulgaria, Caucasus, Transcaucasia, Scotland, the Carpathians, Serbia and East Africa. The material belongs to the collection of the National Museum of Natural History in Sofia (50 skulls of *F. silvestris* and 53 of domestic cat), the Central Sore for Wildlife Furs in Sofia (380 furs of *F. silvestris* and 53 of domestic cat), the Saint Petersburg Institute of Zoology, the Zoology Museum at the Moscow State University (Caucasian *F. silvestris* material and *F. libyca ocreata* material), the Georgian National Museum, the National Museum of Natural History - Washington, DC (african cats material), the Natural History Museum in Paris. We have also used at about 100 photos of wild cats and hybrids from all over Europe and the other regions mentioned (incl. unpublished scientific photos that were kindly let at our disposal by Dr. E. Barrat, Zoological Society of London and Dr. L. Shevchenko, Kiev Institute of Zoology). We have checked 24 qualitative skull features that are either reported in different papers (SUMINSKI, 1962; KRATOCHVIL, 1973; BURCHAK-ABRAMOVICH, 1973) or are introduced for the first time by us. For the first time is also made a statistical analysis of 39 features of the coloration pattern of furs (Fig. 1) from 115 wild and 53 domestic cats, as well as furs of 30 living domestic cats and 9 hybrids from the Sofia Zoo. The coloration features proposed by SUMINSKY (1962), some features that are partially borrowed by HALTENORTH (1957), WIEGEL (1961), HEPTNER and SLUDSKY (1972), and a large number of newly introduced features (especially No. 3, 17, 21, 22, 25, 31 and partially No. 2, 16, 24, 32, 37) were used as a matrix of the features of the coloration.

The differences of the coloration of the wild and the domestic cats are checked for statistical reliability through t_{cr} of Student (reliability $p = 0.001$), calculated according to the formula proposed by WEBER (1961). The correlation options were checked by X^2 , according to VENEDIKOV (1992).

We decided it is worthwhile to check whether the differences between the wild and the domestic cat also account to a great extent for the European *F. silvestris* and the wild ancestors of the domestic cat. Therefore, this analysis of the differences in the skulls and the coloration patterns of the European wild and domestic cat takes into consideration the following:

1. The concept of the origin of the domestic cat.
2. The concept of the taxonomy of *F. silvestris*.

Systematics of *Felis silvestris*

Two main assumptions contradict in the argue concerning the systematics of *Felis silvestris*. According to the first one two separate species exists - *F. silvestris*

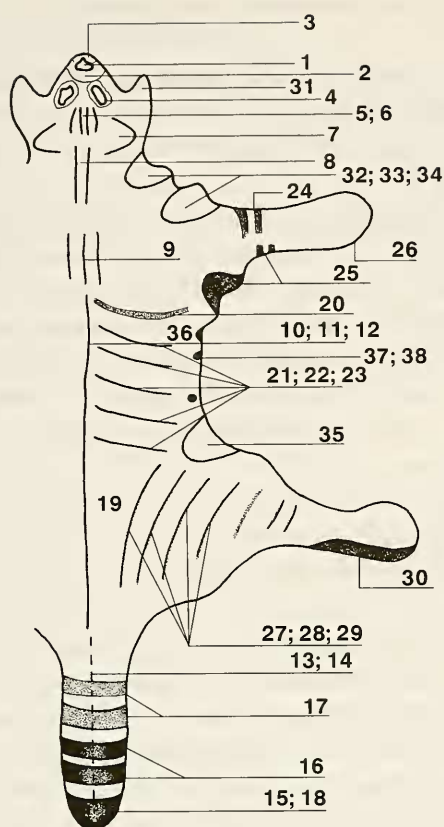


Fig. 1. Scheme of the matrix of the studied coloration pattern features.

of sub-species - *silvestris* group and *libyca* group. This seems to be closer to the truth. In terms of evolution and taxonomy, it is more correct the expression „groups“ to be replaced by the term „semispecies“. This term is introduced by the evolutionists Dobzhansky and E. Mayr for the cases of two sister, new species are still in a formation and differentiation process (MAYR, 1969).

According to our concept the European and the African (from the Northern part of the continent) - Asian cats are on the semispecies stage in the species formation process. This concept is based on the following: actually, there are no 100% sure diagnostic morphological features differing the steppe wild cat (semispecies *libyca* and its sub-species) and the European forest wild cat (semispecies *silvestris*); there is a significant number of differentiating features, that show the obvious trends separating the two forms, although these features may not be appearing in all specimens in a typical manner. The combination of such features gives reliable opportunity to differentiate the two semispecies.

(in Europe) and *F. libyca* (in Africa and Asia), each of them represented by sub-species (POCOCK, 1951). The second assumption states that these forms should be united within the frames of one species, represented by sub-species (HALTENORTH, 1957). Lately, this concept is the more popular. However, it should be noted that the most recent morphologic and genetic surveys (RANDI et RAGNI, 1986; 1991) that support it are based on samples of European wild cat originating from Italy and Sicily, where the domestic cat introgression has probably been significant since the Roman times. This could have influenced the results of the comparison with the *libyca* form. The classification of HEPTNER and SLUDSKY (1972) makes a compromise between the above mentioned hypotheses. According to it there are two groups

Intraspecific taxonomy of the european semispecies

Our experience shows that the qualitative features of the skeleton that are been formed slowly, are more indicative for the differences at the species level, while at the sub-species level the alterations of the coloration pattern that are manifested faster, are especially indicative.

According to us the comparison of the coloration of the Caucasian and the Balkan wild cat, does not indicate for reliable differences of the two forms, in spite of the fact that some contemporary authors state that there is a morphometric distinction of the Caucasian form (PUZACHENKO, 1992). The type *F. daemon* Satunin, was identified by us as a melanistic domestic cat (N. Spassov). We can adjoin the Carpathian population - practically identical in coloration with the above mentioned two populations, although the specimens with more patterned body are probably more frequent in this case. The occurrence of visible stripes in the coloration of the West European wild cat seems to be expressed more often. It may be a manifestation of cline variability (HEPTNER and SLUDSKY, 1972), but it is also possible that the domestic cat introgression influences the coloration pattern, too. There are no reasonable evidences that more than one sub-species of wild cat exists in continental Europe. However, the Mediterranean island populations and the Scottish wild cats show obvious differences from the continental form. The major differences in the Scottish wild cat are the contrast of the body stripes, that are also strongly broken and the fact that the body and the legs are significantly patterned. At the same time, the coloration of the recent specimens is indicative for a strong influence of a crossbreeding with the feral domestic cats. In a sample of 12 furs, that were studied by us, at least 75 % turned out to be hybrid phenotypes. We could propose three hypotheses:

1. The Scottish wild cat has a marginal coloration type of the European semispecies, with a strong demonstration of melanistic pigmentation.
2. The Scottish wild cat is a sub-species of the *libyca* semispecies.
3. The population is hybrid one, at least presently.

However, the first two statements, do not exclude a strong influence of the domestic cat, which is also proved by the investigations of skulls (FRENCH et al., 1988).

Origin of the domestic cat

There is a consensus on the hypothesis that the domestic cat does not originate from the wild European cat, but is rather related to the steppe African-Asian forms (ZEUNER, 1963; KRATOCHVIL and KRATOCHVIL, 1976). The different opinions diverge from this point. Usually it is accepted that the domestic cat is linked by its origin to Egypt (GINSBURG et al., 1991), but obviously the problem is more complex.

We should remark that the coloration of the North African *F. silvestris libyca* differs from the coloration of the domestic tabby (tiger) type cats. Our observations (N. Spassov) indicate that the coloration of the wild cats from Northern Kenya and some regions in Ethiopia are almost identical to the coloration patterns of the domestic tabby type cats. Some surveys show that the origin of the domestic cat may be polyphyletic - linked to several sub-species of the steppe group of forms (semispecies), and that the *F. silvestris ornata* from Asia Minor could also have contributed to the formation of the domestic cat (BURCHAK-ABRAMOVICH, 1973). We should note that according to some new assumptions the earliest known domestic cat is that of the Cyprus Neolithic (DAVIS, 1987). However, the following should be underlined: the coloration pattern and the skeleton morphology of the domestic cat are characterized by features typical for the forms of sub-species of the *libyca* semispecies from Asia Minor and Africa.

Variability of the skull features of the european wild and domestic cats

The diagnostic features of the domestic cat, differentiating it from the wild European one can be grouped as follows:

1. Features inherited from the wild ancestor - the sub-species of the *libyca* semispecies, that actually express the differences between the forest European and the steppe African-Asian groups.

It seems that such are: the position of the foramen palatinum majus, the form of the foramen lacerum and the distance between it and the foramen ovale etc., (see: the demonstration of the features of the domestic cat - SUMINSKI, 1962). Amongst these features there are ones that reflect significantly the morphologic-functional differences of the two wild semispecies. They relate to their different ecology and ethology, connected with the different formation environment - the forests and the steppe. For the steppe cats (respectively for the domestic cats) such are the distinct development of the ectotympanal part of the bullae ossae and the broad meatus acusticus externus; the flat (and even concave in males) frontal bones - flat in 90% of the females and bulging in the rest 10%, and flat in 47% to concave in 53% of the males (dom. cats - $n = 50$) (Fig.2); the strong processus zygomatici of the frontal bones. Probably the last two features are partially related with the strong jaw muscles, connected with the worrying of larger prey by the forms of the open spaces - one of the main preys of the steppe sub-species *F. silvestris ornata* are the hares (NOVIKOV, 1962). May be the evolution of these two features is also partially due to the evolution of stronger mimic muscles, linked to the more frequent visual contact and interspecific demonstrations of aggressiveness of the steppe forms. The domestic cat is even more social, because of the frequency of the

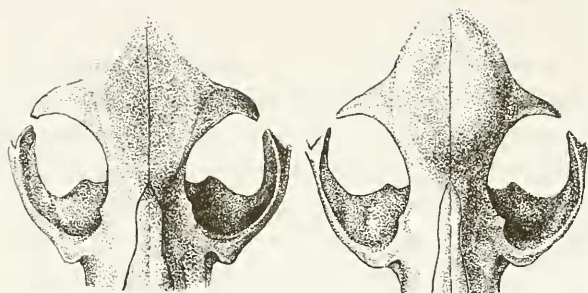


Fig. 2. Skulls of *F. silvestris*: frontals flattened - the semispecies *libyca*; the frontals convex - the semispecies *silvestris*.

compared to the *silvestris* form, it could be explained by the reduced olfaction of the steppe forms compared to the forest ones. Subsequently, the frontal sinuses, that increase the olfaction of *F. silvestris*, are less developed in the steppe forms.

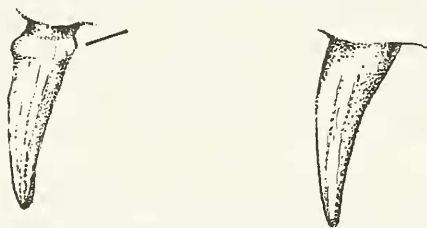


Fig. 3. Upper canine of *F. silvestris* (without cingulum) and *F. catus* (with cingulum).

European wild cat, often appears in the *libyca* semispecies and enlarges proportionally with the decrease of the section of the tooth of the domestic cat. The bullae ossae of the domestic cats although paradoxically well developed in comparison with the European wild cat, are relatively poorer than the ones of *libyca* form.

Results of the analysis of the coloration pattern features

Of the 39 features of the matrix used (Fig.1), here are represented only the features giving the most significant differences between the wild European and the domestic cat, that could be used for identifying the hybrids.

Feature # 2. Coloration of the muzzle (2.1. Colour differing from the one of the frontal part; 2.2. Colour the same with the one of the frontal part). This feature

mating periods and the limited home range. The mimic display is especially active. Therefore, these features (see especially the males) are even more developed. Subsequently, some forms of the skull of the domestic cats, e.g. the zygomatic processes, are relatively more robust, even though it seems paradoxical from first sight. What concerns the trend for flattening of the frontal bones, com-

pared to the *silvestris* form, it could be explained by the reduced olfaction of the steppe forms compared to the forest ones. Subsequently, the frontal sinuses, that increase the olfaction of *F. silvestris*, are less developed in the steppe forms.

2. Features of degeneration, related to the domestication. Apart from the smaller skeleton, the gracilization of the carnacials and the canines and partially the reduction of the brain skull and of the mandible coronoid processus, we can add the development of the cingulum of the upper canine (in 87% of the cases, $n = 53$) (Fig. 3). The lat-

est is not demonstrated in the

gives 100% difference between the wild and the domestic cat, does not give difference between the pure wild cats and the hybrids.

Feature # 3. Coloration of the upper lip. It was light ochre or greyish in 97% of the wild cats and 43% of the domestic cats. White in 0% of the wild and 55% of the domestic cats.

Feature # 13. Continuation of the dark dorsal stripe to the dorsal part of the tail. In 53% of the cases of the examined *F. silvestris*, the dorsal stripe reaches the tail rings without crossing them ($t^{cr} = 6.5$). In 15% of the cases the dorsal stripe crossed the rings and in 32% it did not reach them at all ($t^{cr} = 4.6$). In 97.5 % of the domestic cats with wild coloration pattern the dorsal stripe crossed the tail rings (t^{cr} is almost 10). The situation with the hybrids from the Sofia Zoo was quite close - this was observed in 80% of the cases. The feature could be used as indicative for the cross-breeding. The assumption that the continuation of the dorsal stripe of the wild cat is always straight and that of the domestic cat is always zigzag like was not proved statistically.

Feature # 15. Length of the dark tail tip (15.1. Short one - when its form is close to square; 15.2. Long one - when its form is close to rectangle). In the case of the wild cats 76% were with short terminal ring and 19% are with long ones. All domestic cats in the examined sample were with long tail tip. The feature is of a high diagnostic value for proving cross-breeding, although in some cases it depends on the thickness of the tail, owing to the summer or the winter coat. The feature 15.2. occurred in 80% of the hybrids from the Sofia Zoo.

Feature # 16. Number of the contrasting (the dark) rings of the tail (Fig.4). For the wild cat they varied from one to six (mostly 2 - in 51%). For the domestic cats the rings varied from four to seven (mostly four - in 44%). Two or three dark rings are characteristic for the wild cat, for numbers above these cross-breeding with domestic cats could be suggested.

Feature # 17. Number of the pale tail rings (situated close to its base) Pale rings were not observed in the cases of the domestic cats. However, 50% of the hybrids from the Sofia Zoo had this feature. The number of the pale rings varies from 0 to six (mostly 2 - in 47% of the cases) in *F. silvestris*. Their lack is not always indicative for cross-breeding.

Feature # 18. Form of the tail tip (sharp or blunt). This feature was examined on winter coat only. Regarding the wild cats, 82% had a blunt tail tip, and only 15% had a sharp one. All domestic cats had sharp tail tips. Of the hybrids in the Sofia Zoo 90% were with sharp tail tips. The high figure of the t^{cr} proves the diagnostic value to identify the cross-breeding.

Feature # 21. Broken body stripes (21.1. The stripes are strongly broken - on more than three spots and obviously separated from each other; 21.2. The stripes are scarcely broken - on two or three spots and their separation is just marked; 21.3. The stripes are not broken at all). Of the wild cats examined 2% were with

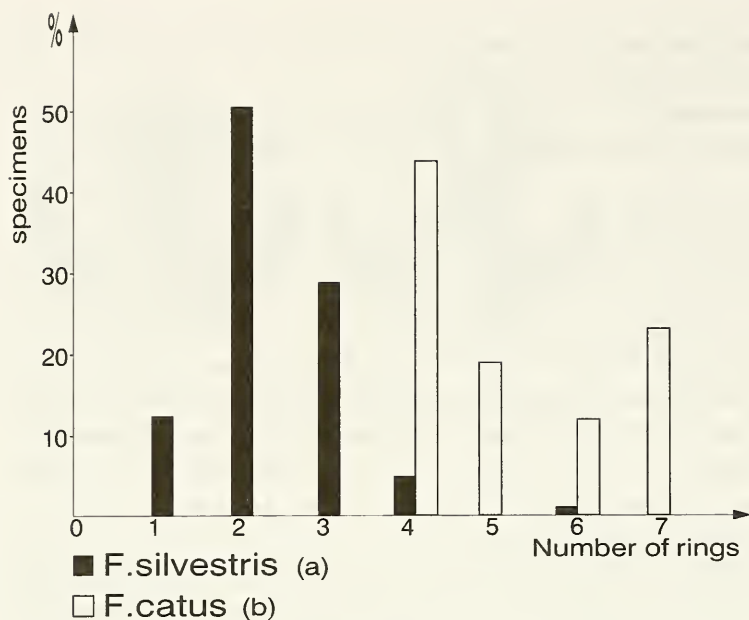


Fig. 4. Number of the dark tail rings:
a - wild European cat; b - domestic cat.

strongly broken body stripes, 25% were with scarcely broken, 30% were with unbroken stripes and 43% were without stripes. Actually the percentage of the wild type domestic cats with broken body stripes comes to 100%, as the $t_{cr.}$ equals 11.6, that indicates for a feature with high diagnostic value. The same was

observed in the cases with the hybrids from the Sofia Zoo. The stripes were most strongly broken in the back third of the body, as in the case of the domestic cats they are transformed into spots. Correlation was established between the size of the fur of the wild cats and the ratio to which the stripes are broken. The number of specimens with unbroken body stripes is much higher in the larger size furs. This data agrees with the fact that the coloration of the young animals is strongly broken. The occurrence of strongly broken body stripes or of „spots“ in the coloration of a wild cat specimen, could be explained by:

1. Possible cross-breeding;
2. The fact that the examined specimen is a young one, with an adult size, but a sub-adult coloration pattern.

These specimens are caught most often.

Feature # 22. Cross body stripes (side stripes) contrasting to the background colour. The stripes of the wild cats were contrasting, well demonstrated in 8% of the cases (sub-adult animals?), were scarcely notable in 49% and in 43% of the animals they were lacking. In the case with the domestic cats 90% had contrasting cross body stripes (no lighter than the longitudinal dorsal stripe) and the remaining 10% had comparatively lighter stripes (in this case these were rosettes - lighter in the middle, that are lacking in the coloration of *F. silvestris*). There were no domestic cats without cross stripes at all. The hybrids from the Sofia Zoo were with visible horizontal stripes in 80% of the cases. With a $t_{cr.} = 10.6$ this is one of the

best diagnostic features for the occurrence of cross-breeding. The contrasting stripes are a sure proof for hybridization with domestic cat, while the lack of such stripes or their lighter colour are the most typical feature of the wild cat coloration.

Feature # 24. Occurrence of stripes or spots on the lateral side of the fore leg (Fig. 5). Of the wild cats 48% were without stripes, 42% were with one or two stripes and 7% were with three to five stripes. In the case with the domestic cats 37% were with three stripes, 62% were with four stripes and 2% were with six stripes. The values of the χ^2 indicate that the wild cat is characterized by a coloration of a high reliability in the interval: 0 stripes - 2 stripes, and as a diagnostic feature for cross-breeding can be used the occurrence of more than three stripes.

Feature # 25. Occurrence of stripes or spots on the inner part of the fore leg (Fig. 5). (25.1. Occurrence of dark spot on the armpit; 25.2. Occurrence of one or

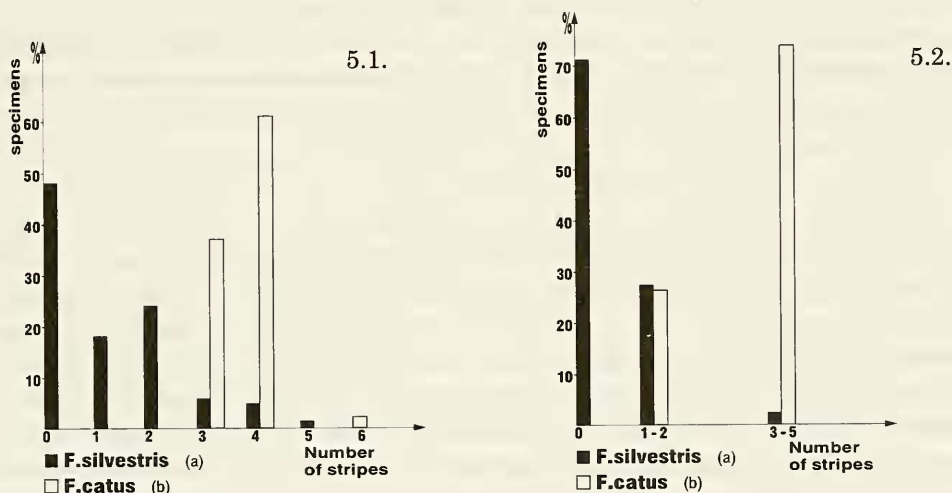


Fig. 5. Distribution of the fore leg coloration pattern features.

5. 1. Number of stripes on the lateral side: a - wild European cat; b - domestic cat.

5. 2. Number of stripes on the inner side: a - wild European cat; b - domestic cat.

two stripes; 25.3. Occurrence of more stripes). Dark spot on the armpit occurred in 100% of the wild cats. In 71% it was separate, and in 26% occurred together with one or two stripes. Just in 1.8% the dark armpit occurred together with three to five stripes. The dark spot on the armpit was lacking in 100% of the domestic cats, in 26% one or two stripes were observed and three to six stripes occurred in 73% of the cases. The dark spot on the armpit is one of the characteristics of the wild cats. The larger number of stripes on the inner side of the front leg is indicative of possible cross-breeding.

Feature # 30. The length of the dark spot on the plantar (posterior) surface of the metatarsus. This feature has the following distribution for the wild cat: in 4% the whole surface was black, and for the remaining 96% it varied from brown to

ochre, usually being darker (a dark spot) in its lower part. The metatarsal surface of the domestic (tiger) cats was completely black in 92% and in 7% it was brown or light grey with black. In both cases the t^{cr} is over 11. The feature: „the whole surface is black“ is a reliable diagnostic feature for cross-breeding (as Suminski had pointed out).

Feature # 31. The colour of the chin (the mandibular area). For the wild cat it was grey in 44% of the cases, ochre in 49% of the cases and purely white only in 7%. The chin of the domestic cat was more or less white - in 100% of the cases. Regarding the hybrids the white chin is a reliable diagnostic feature. Of the hybrids from the Sofia Zoo 40% had white chin. Therefore, we believe that the description according to which the wild cat has a white chin (STAHL and LEGER, 1992) is linked to the observations on samples from Central and Western Europe, where the phenotype is influenced by introgression of the domestic cat.

Feature # 32. White spots (areas) on the ventral side of the body. In the case with the wild cat the spots varied from one to three and were usually oval-shaped, occurring on the neck, on the breast and on the groins, and distributed as follows: a spot on the groins only - 10%, a spot on the breast - 0%, a spot only on the neck - 12%, spots on the neck and on the groins - 27%, spots on the breasts and on the groins - 3.5%, spots on the neck and on the breasts - 8.7%, spots on the three parts in 28% and in 11% of the cases the spots were lacking. In general, spots occurred on the groins in 68.5% of the samples observed, on the breasts in 40% of the specimens and on the neck in 76%. The white spots are one of the characteristic features of the wild cats coloration. In the coloration of the domestic cats they are either lacking or are just a demonstration of partially albinistic coloration (WIEGEL, 1961). In such cases they are odd in shape and location and they are unexpectedly large. Out of several hundreds of wild cats only in single specimens is observed fusion of the spots on the neck and the one on the breasts. This phenomenon should be considered an indication of cross-breeding. Such is also the strong and unevenly spread white coloration on the abdominal part of the body, as well as the demonstrations of leucocism on the legs and the tail, described by some authors as an usual coloration of the wild cat (SLADEK, 1976).

Feature # 37. Number of the dark spots on the abdomen. Regarding the wild cat the spots were lacking in 46% of the cases, 8% (sub-adult specimens?) had a large number of spots (more than four) and 45% had a few spots. Of the domestic cats 100% were with many spots ($t^{cr} = 11.4$). Hence, the large number of spots could be used to prove the cross-breeding between the wild and the domestic cats. The features with statistically proved reliability and accepted by us for diagnostics were analyzed to determine the correlation of their demonstrations. The study on the correlation of the statistically reliable features gives negative result, i.e. the diagnostic features could be independently inherited by the hybrids. Of the wild specimens examined 56.7% had at least one feature that can be indicative for the

cross-breeding: 29% had only one feature, 13% had two indicative features, 7% had three ones, four features were demonstrated in 5%, only in 1.7% had five features, and just one juvenile specimen (!) had 8 features.

For the domestic cats when only one or two atypical features are demonstrated, the figures for $t^{cr.}$ characterizing the features distribution shown statistically significant differences between the domestic and the wild ($t^{cr.} = 3.65$). Consequently, the coexistence of three or more of the diagnostic features could be indicative for reliable cross-breeding. The feature # 22 occurs in statistically significant combinations with other one indicative for the cross-breeding with a $t^{cr.} = 5$, that makes it the feature with the highest diagnostic value. The features # 24, 30, 31, and 37 are also reliable, although there is higher mistake probability. The occurrence of these features shows that the cross-breeding probability increases.

According to the study of the Bulgarian population the percentage of the probable hybrids - with a simultaneous demonstration of three or more diagnostic features - in the sample examined is 14%. However, this figure is substantially increased as most probably the coloration of a number of the specimens is of a sub-adult type.

Description of the coloration of the wild european cat (Fig. 6-9)

The colour of the nose more or less varies from brick to dark pink. There is a characteristic rusty coloration around the muzzle. The upper lip varies from greyish to ochre like to the same extent. Usually there is a ring in the same colour around the eyes, but it is lacking in some specimens. The frontal stripes are two to four, and three stripes occur very rarely. The unbroken frontal stripes dominate, yet sometimes broken in different extents stripes occur. The ear hairs are usually grey. The neck stripes vary from one to four, and in the case when the stripe is just one it is broad and unclear. The longitudinal shoulder stripes are one to three. The longitudinal dorsal stripe is always one, and predominantly unclear in the periphery area. The dorsal stripe never crosses the tail rings. The dark tail tip is blunt and short. The tail rings coloration is of two types: contrasting - their number is two or three; pale - the number is one or two. The background colour of the body is a range of tonalities derivative of the „bistre“ according to Ridgway. Of the side stripes the one on the shoulder-blade is most strongly demonstrated. When there are other side stripes it is often darker than the rest. Even when the side stripes are lacking the one behind the shoulder is present. The specimens of one colour (without side stripes) are dominant, yet there are different extents of patterned coloration, but the side stripes are pale and patterns with contrast side stripes occur scarcely (sub-adult animals?). The side stripes are unbroken along the whole

length of the body, and sometimes they are slightly broken in the pelvic part. Whenever they are present they are lighter than the dorsal stripe. The number of the side body stripes varies in a broad range, most often they are five to six. The lateral part of the fore leg is without stripes or with one or two pale stripes. There is always a dark spot on the armpit. The stripes on the hind legs are darker than the body stripes, or are the only stripes present. Usually they are three to five and most often they are unbroken. The black spot on the metatarsus is little, lowly located or lacking at all. In these cases the metatarsus is brown or grey. The chin varies from greyish to ochre like. The white spots occur most often on the neck, than on the abdomen and they rarely appear on the breast. In the last two cases the spots are usually little. The white spots (areas) on the ventral body part appear in different combinations and could also be lacking. The background colour of the abdomen, the inner side of the hips and of the groins is bright, derivative of the ochre. The abdomen is patterned by a few - three or four - dark spots that do not appear always.

Description of the coloration of the wild type domestic cat (Fig. 6-9)

The colour of the nose is pink. The upper lip is most often white. The rusty col-

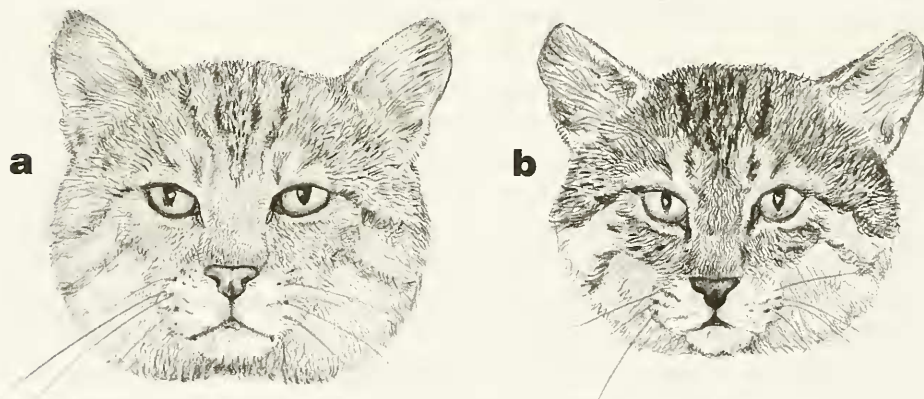
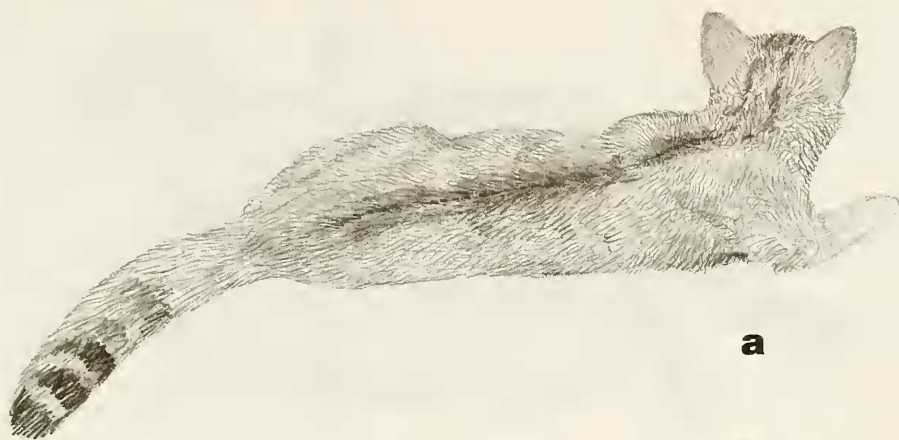


Fig. 6. The typical head coloration pattern of: a - European wild cat; b - domestic cat „wild (tiger)“ coloration type.

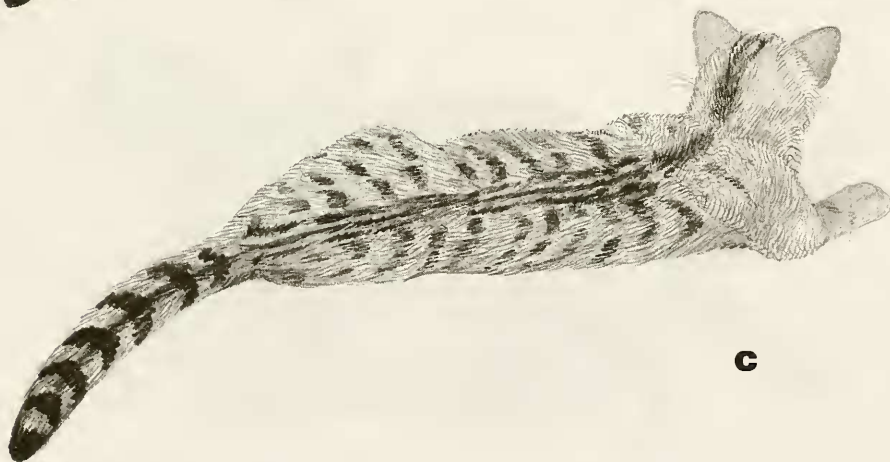
oration lacks. There is a greyish-white ring around the eyes. The number of the frontal stripes is most often four, or they are replaced by separate small spots. The stripes could be broken or not with equal probability. The longitudinal neck stripes vary from two to four and the ones on the shoulders from one to four. The number of the dorsal longitudinal stripes is one to three. Specimens with unclear limits of the dorsal stripe dominate. In most cases the dorsal stripe continues to the tail and



a



b



c

Fig. 7. Dorsal coloration patterns: a - typical pattern of the European wild cat; b - domestic cat; c - domestic cat.



Fig. 8. Body stripes patterns: a - typical; b - stripped varieties of body coloration patterns of the European wild cat; c - domestic cat „wild“ coloration type.



a



b



c

Fig. 9. Ventral spots coloration patterns: a - varieties of the European cat; b - varieties of the European wild cat; c - domestic cat „wild“ coloration type.

crosses the tail rings and the form of this extension is most often zigzag like. The dark tail tip is long and sharp. There are no pale tail rings, and the number of the strongly contrasting ones is more than three. The background body colour is derivative of the grey and the beige, and in some cases it is close to black. The side body stripes are numerous - over seven, strongly broken, as dark as the dorsal stripe is. There are lighter rosette like spots, too. There are more than three bright stripes on the fore leg. The stripes on the hind legs are bright (contrasting) and the same as the body stripes. The armpit spot lacks. The metatarsus is completely black. The colour of the chin is white, and the one of the abdomen is greyish to brown-greyish. Except for the cases of partial albinism, there are no white spots on the abdomen. In the cases when they are present they are of an irregular form. The dark abdominal spots are numerous and usually small.

Conclusions

Features characteristic to the wild cat. These are: rusty muzzle, light ochre upper lip, rings around the eyes of the face background colour or ochre like, occurrence of one dorsal stripe that never reaches the tail rings, blunt and short tail tip, two or three contrasting tail rings and the same number lighter ones, unbroken and slightly contrasting side body stripes or one coloured body, lack of stripes or one - two stripes on the fore leg, black spot on the armpit, short black metatarsal spot, coloration of the chin differing from the white, one to three white, oval-shaped spots on the ventral part of the body (on neck - occurring most often, on the groins and on the breast), a small number of dark spots - up to four, on the abdomen. Generally, the evolution of the European wild cat coloration is directed to minimizing of the pattern, darkening of the background colour, that correlates with the ecological factors in the conditions of nemoral biotope.

Features characteristic to the domestic cat with coloration of the wild type. These are: extension of the dorsal stripe to the tail rings, long and sharp dark tail tip, a large number of contrasting rings and lack of pale rings on the tail, strongly broken and contrasting horizontal body stripes, black metatarsus (caudal surface), white chin, lack of white spots on the ventral side (except for the cases of partial albinism), a large number of the dark spots on the abdomen, and a large number of stripes on the outer side of the front legs.

Features of the hybrids. Sometimes it is difficult to differentiate the coloration of the sub-adult and the hybrid specimens, especially regarding the cross body stripes and the metatarsus surface colour. A number of the features differing the wild and the domestic cat are not applicable in the case of the hybrids. The features characteristic to the domestic cat, appearing in a combination of three or more in a single specimen are a reliable indication for cross-breeding. The features

22, # 21, # 24, # 31, and # 37 have the highest significance for cross-breeding.

Purity of the bulgarian population. The ratio of cross-breeding of the Bulgarian wild cat has been determined, based on a large sample examined, with a significant reliability. Excluding the obvious hybrids (with a manifestation of a strong leucocism) the percentage of the hybrid/sub-adult coloration pattern is 14%. We could assume that the cross-breeding in Bulgaria, could reach 8 - 10%, counting the obvious hybrids. It seems to be quite low percentage, probably the figure for Western Europe will be much higher. The Bulgarian wild cat population is amongst the purest in Europe with high population number and density (SPIRIDONOV and SPASSOV, 1994). However, the conclusion could be drawn that the cross-breeding is one of the factors seriously threatening the wild cat population.

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**Дивата котка (*Felis silvestris* Schr.)
и скитащите домашни котки:
проблеми на морфологията, таксономията,
идентификацията на хибридите и чистотата
на дивата популация**

Николай СПАСОВ, Велизар СИМЕОНОВСКИ, Жеко СПИРИДОНОВ

(Р е з ю м е)

Въпросите за морфологията, систематиката и изменчивостта на окраската на дивата европейска котка и на домашната котка с „див“ тип окраска остават спорни или неясни. Изясняването на въпроса за окраската е важен също във връзка с друг важен консервационен проблем - проблема за хибридизацията между дивата популация и скитащите домашни котки. Настоящата работа е синтез на резултатите от изследването на черепната морфология, окраската и въпросите на систематиката на *F. silvestris*. Тя представлява също и изследване на проблема за кръстосването в природата на дивата и скитащата домашна котка. Проучени са качествените черепни морфологични белези върху повече от 130 черепа на диви и домашни котки, едновременно със 39 белези на окраската върху повече от 500 кожи и над 100 снимки от Европа, Кавказ, Мала Азия, Северна и

Източна Африка. Според предлаганата хипотеза Европейската (горска) дива котка и Афро-азиатската (степна) котка са в стадий на „семиспециеси“ в процеса на видообразуването. Няма реални основания да се смята, че в континенталната част на Европа съществуват повече от един подвид на дивата котка. Шотландската дива котка показва, обаче, значителни разлики от континенталната форма. Произхода на домашната котка вероятно е полифилетичен - свързан с различни подвидове на степния полувид (семиспециес), включително с формата, обитаваща Северна Кения и Етиопия. Диагностичните черепни белези на домашната котка, по които тя се различава от дивата европейска, могат да бъдат групирани по следния начин:

1. Белези, наследени от дивия предтеча - подвидовете на семиспециеса „*libyca*“.

2. Белези на дегенерация, свързани с доместикацията.

Поне 15 белега на окраската могат да бъдат използвани като диагностични за разграничаването на европейската дива от домашната котка с див („тигров“) тип окраска. Проявите на всички тези белези при домашната котка могат да бъдат използвани за доказване на хибридизация, когато поне три от тях са представени едновременно. Освен леукоизма няколко други признака имат особено висока диагностична стойност като индикатори на хибридизация: силно контрастни и прекъснати напречни ивици на тялото; брой на тъмните коремни петна; (оцветяването на брадичката) и шарката на предните крайници. Предполага се, че хибридизацията на българската популация на дивата котка достига 8 - 10%, което вероятно е между най-ниските стойности в Европа.